

REMARKS/ARGUMENTS

Favorable consideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-6, 11, and 13-16 are pending in the application, with Claims 1, 5, 6 and 11 amended by the present amendment.

In the outstanding Office Action, Claims 1, 3, 6, and 11 were rejected under 35 U.S.C. § 102(b) as being anticipated by Halvis et al. (U.S. Patent No. 5,164,832, hereinafter Halvis); Claims 13-16 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Halvis in view of Bluzer et al. (U.S. Patent No. 4,488,163, hereinafter Bluzer); and Claims 2 and 3 were indicated as containing allowable subject matter.

Applicants gratefully acknowledge the indication of the allowable subject matter.

Claims 1, 3, 6, and 11 are amended to recite that “the electric charge generated in the light-receiving device is accumulated in the light-receiving device when an OFF voltage is applied to the transfer device, and the electric charge generated and accumulated in the light-receiving device is transferred from the light-receiving device to the charge-accumulating section when an ON voltage is applied to the transfer device.” Support for this amendment is found in Applicants’ originally filed specification.¹ No new matter is added.

Briefly recapitulating, amended Claim 1 is directed to an image pickup apparatus comprising an array of unit cells arranged in rows and columns, each unit cell having

- a light-receiving device configured to receive light and generate an electric charge corresponding to the light,
- a charge-accumulating section configured to accumulate the electric charge generated by the light-receiving device,

¹ Specification, page 15, line 23 – page 16, line 14.

- a transfer device configured to transfer the electric charge from the light-receiving device to the charge-accumulating section,
- a charge-limiting device configured to limit the electric charge accumulated in the charge-accumulating section, and
- an amplifying device configured to amplify a voltage signal corresponding to the electric charge in the charge-accumulating section
- the electric charge generated in the light-receiving device is accumulated in the light-receiving device when an OFF voltage is applied to the transfer device, and the electric charge generated and accumulated in the light-receiving device is transferred from the light-receiving device to the charge-accumulating section when an ON voltage is applied to the transfer device;

The image pickup apparatus also comprises a plurality of vertical signal lines extending along the columns of unit cells, respectively, each configured to receive the amplified voltage signal amplified by the amplifying device of any unit cell of the associated column. The image pickup apparatus also comprises a control circuit configured

- to control each of the unit cells,
- to cause the charge-limiting device to limit the electric charge generated by the light-receiving device during a first period and transferred to the charge-accumulating section through the transfer device,
- to cause the charge-accumulating section to hold the electric charge limited by the charge-limiting device, and
- to add to the electric charge held in the charge-accumulating section, an electric charge generated by the light-receiving device during a second period following the first period and transferred to the charge-accumulating section through the transfer device.

Independent Claims 5, 6, and 11 are directed to alternative embodiments of Applicants' invention, Applicants' claimed image pickup devices allow for increased dynamic range and simultaneous signal read out.²

Halvis discloses a solid state imaging apparatus where a signal ϕ IG is supplied to an input transistor (transfer gate) 810 is kept constantly at a low potential level.³ Halvis does not disclose or suggest "the electric charge generated in the light-receiving device is accumulated in the light-receiving device when an OFF voltage is applied to the transfer device, and the electric charge generated and accumulated in the light-receiving device is transferred from the light-receiving device to the charge-accumulating section when an ON voltage is applied to the transfer device" as recited in Applicants' amended independent claims. Accordingly, the electric charge generated in the light-receiving device (detector element 102) is not accumulated in the light-receiving device, but immediately transferred to the charge-accumulating section (capacitor 812) via the transfer gate 810. As a result, with Halvis, the electric charge generated in the light-receiving device is accumulated in the charge-accumulating section for a long time. Thus, a voltage signal accurately corresponding to the received light is not obtained.

Bluzer discloses an array of photodetectors incorporating a PNP vertical structure.⁴ However, like Halvis, Bluzer fails to disclose or suggest the electric charge generated in the light-receiving device is accumulated in the light-receiving device when an OFF voltage is applied to the transfer device, and the electric charge generated and accumulated in the light-receiving device is transferred from the light-receiving device to the charge-accumulating section when an ON voltage is applied to the transfer device."

² Specification, page 4, lines 25-27.

³ Halvis, column 12, lines 47-64.

⁴ Bluzer, abstract.

As none of the cited prior art, individually or in combination, disclose or suggest all the elements of independent Claims 1, 5, 6, and 11, Applicants submit the inventions defined by Claims 1, 5, 6, and 11, and all claims depending therefrom, are not anticipated and are not rendered obvious by the asserted prior art for at least the reasons stated above.⁵

Accordingly, in view of the present amendment and in light of the previous discussion, Applicants respectfully submit that the present application is in condition for allowance and respectfully request an early and favorable action to that effect.

Respectfully submitted,

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⁵ MPEP § 2142 "...the prior art reference (or references when combined) must teach or suggest **all** the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)."